The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Weekly Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Weekly Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-96, *Development of DOE Lessons Learned Programs*.

To issue the Weekly Summary in a timely manner, the Office of Operating Experience Analysis and Feedback (OEAF) relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the summary, please bring this to the attention of Jim Snell, 301-903-4094, or Internet address jim.snell@hq.doe.gov, so we may issue a correction.

Readers are cautioned that review of the Weekly Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Weekly Summary 97-19

May 2 through May 8, 1997

Table of Contents

Visit Our Web Site

The Weekly Summary is available, with word search capability, via the Internet at **http://www.tis.eh.doe.gov/web/oeaf/oe_weekly/oe_weekly.html**. If you have difficulty accessing the Weekly Summary at this URL, please contact Mark Mortensen at 208-525-3753 for assistance.

EVENTS

1. OPERATIONAL SAFETY REQUIREMENTS INCONSISTENT WITH FACILITY ENVIRONMENTAL REQUIREMENTS

On April 30, 1997, at the Hanford Tank farms, engineers reviewing a safety analysis report discovered that an Operational Safety Requirement (OSR) was inconsistent with the updated facility environmental requirements. The OSR stated that effluent record samples from a building ventilation exhaust stack should be obtained weekly. The revised policy and procedures for environmental compliance stated that the samples should be obtained bi-weekly. Investigators determined that the OSR was not changed when the sampling requirements were revised in 1994. Failure to evaluate and revise OSRs in response to changing facility missions and requirements could result in unreviewed safety questions. (ORPS Report RL--PHMC-TANKFARM-1997)

The exhaust stack is connected to the ventilation system of a building used to receive liquid waste from Hanford facilities. Technicians process the liquid waste in the building for storage in the double-shell tanks. Attached to the exhaust stack are two sample lines used for continuous monitoring of the exhaust flow and for periodic sampling by technicians. The original facility environmental requirements specified taking a weekly grab sample in addition to continuous air monitoring.

Investigators determined that in 1994, engineers decided that the radiological surveillance program requirement for weekly sampling of the stack could be relaxed to bi-weekly sampling. The engineers determined the bi-weekly requirement was consistent with the National Emissions Standard For Hazardous Air Pollutants and the bi-weekly samples were more accurate than weekly samples. Personnel from a site environmental group wrote a memorandum to the radiological control group requesting a revision to the sampling procedures. Radiological control technicians changed the procedures as requested. The site environmental group also wrote a memorandum to the plant group requesting a change in the OSR. Investigators determined that personnel never responded to this request.

The facility manager curtailed all activities involving radioactive materials until technicians could determine that the sampling of the stack was in compliance with the OSR weekly requirement. Radiological control technicians instituted a temporary procedure change reinstating the weekly surveillance until the OSR can be revised. Engineers are planning to delete the grab sample requirement in the new basis for interim operations that will replace the OSR.

This event illustrates the importance of proper communication to ensure technical safety requirements and OSRs are accurate and that they are followed. Technical safety requirements were formerly called operational safety requirements at non-reactor facilities. DOE Order 5480.22, *Technical Safety Requirements* (to be replaced by DOE 423.1, but still in use at most sites), section 9.g, states that technical safety requirements must be kept current at all times to reflect the facility as it exists and as analyzed in the safety analysis reports. The Order also states that the technical safety requirements must be changed before the facility changes operations. Managers at DOE facilities should review their safety requirements change program to ensure that communications on required changes are appropriate and there is a mechanism for proper feedback to the originating parties when changes are completed.

KEYWORDS: surveillance, environment, sampling, procedure, operational safety requirement

FUNCTIONAL AREAS: licensing/compliance, management

2. EXPANSION OF ABSORBENT MATERIAL PRESSURIZES WASTE OIL DRUMS

On April 29, 1997, at Los Alamos National Laboratory, eight drums containing waste machining oil pressurized when absorbent material made from corn cobs expanded inside the drums. When a waste coordinator loosened a lid locking ring to allow sampling of one of the drum contents, the lid was ejected and landed 3 feet away. The waste management coordinator and nearby workers were not injured. This was the first time the Laboratory used the corn-cob-based product called Toxi-Dri® as an absorbent material in sealed drums. After the event, the facility manager designee contacted the manufacturer, Mt. Pulaski Products, Inc. The manufacturer's representative said the product can expand to twice its original volume. Discussions with the manufacturer about precautions or recommended mixing ratios before using this product could have prevented this event. Pressurized drums present several personnel hazards including: (1) possible injury from an ejected lid or bursting drum; exposure to the hazardous contents in the drum; or (3) exposure to pyrophoric materials, which can ignite and burn. Pressurized drums can also result in equipment or facility damage from lids and locking rings that become missiles. (ORPS Report ALO-LA-LANL-SHOPSFAC-1997-0004)

During the week of April 7, waste generator personnel mixed the Toxi-Dri® material with waste oil in eight, 55-gallon drums. They left a head space of 5 inches in accordance with guidance from the waste management coordinator and the Laboratory minimum fill requirements of 90 percent. Before personnel sealed the drums, the drums remained open for 2 days to allow the Toxi-Dri® to absorb the oil and to permit periodic mixing of the contents. On the morning of April 29, the waste management coordinator loosened the lid locking ring because he could not open the bung on the drum. This resulted in the lid being ejected and oil-laden corn cob particles being spread in the area around the drum. When he removed the bungs from the remaining drums to relieve pressure, the expanded Toxi-Dri® material flowed from the open bung holes. This indicated Toxi-Dri® expansion caused the pressure build-up in the drums, not gas formation. None of the drums exhibited signs of pressurization, such as bulging, deformation, or rocking.

Waste generator personnel repackaged the 8 drums of expanded Toxi-Dri® and waste oil into 17 drums containing vermiculite, leaving a head space of 20 to 25 percent to allow for any expansion of the Toxi-Dri® material. The facility manager conducted a critique of the event. Attendees determined a design problem (error in equipment or material selection) was the direct and root cause. Waste management personnel will perform further evaluation before continued use of this product in this application.

Investigators determined that waste management personnel used diatomaceous earth and vermiculite for packaging and stabilizing oil wastes before trying Toxi-Dri®. They decided to try Toxi-Dri® because it is biodegradable and easily incinerated. However, they used the procedure for past packing material ratios and void space requirements. The product packaging indicated that Toxi-Dri® was specially designed for oil-based wastes and was 400 percent absorbent. The packaging also indicated the product could be used for solidification, packaging, and incineration. The packaging did not provide any warnings or precautions as to the extent of product expansion.

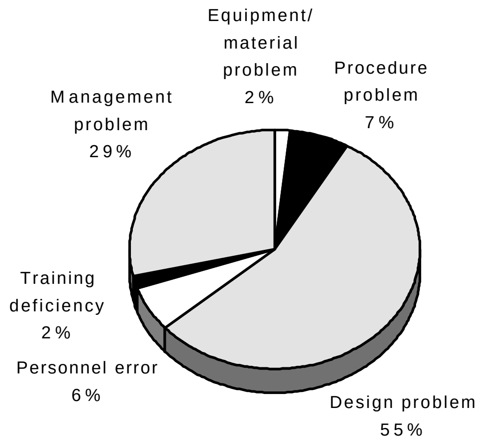
NFS reported drum pressurization events in Weekly Summaries 97-03, 96-48, 96-44, 96-42, 96-04, 95-10, and 95-02.

- Weekly Summary 97-03 reported on January 8, 1997, at the Fernald Environmental Management Project, a hazardous waste worker was loosening a bolt on a 110-gallon drum ring when the lid blew off, striking the ceiling 14 feet above the worker and coming to rest on the floor 3 feet away. The worker was exposed to ammonia fumes. (ORPS Report OH-FN-FDF-FEMP-1997-0003)

- Weekly Summary 96-42 reported two events involving lids that blew off pressurized drums when the locking rings were loosened. On October 9, 1996, at the Paducah Plant, when a waste sampler loosened a locking ring with a hammer, the ring, the lid, and some contents blew out of the drum. The drum contained degrading wood that generated methane gases. On October 7, 1996, at the Hanford Tank Farms, an operator loosened the locking ring on a drum, and the lid flew 3 feet into the air. The drum contained decaying weeds and soil that produced methane gases. (ORPS Reports ORO--LMES-PGDPENVRES-1996-0002 and RL--PHMC-TANKFARM-1996-0076)

- Weekly Summary 95-02 reported that on January 10, 1995, at the Pacific Northwest Laboratory, a drum lid blew off and hit an overhead light fixture when workers loosened a drum lid clamp ring. Four, 120-ml bottles were thrown from the drum; spilling the contents on the floor. Workers had up to 10,000 dpm alpha contamination on their shoes, and the spill area was contaminated to 150,000 dpm alpha and 5,000 dpm beta-gamma. (ORPS Report RL--PNL-PNLBOPER-1995-0002)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for reports with a direct cause of design problem, error in equipment or material selection, and found 189 occurrences. Of these reports six involved pressurized drums. Four reports cited drums that did not have venting capability; another identified an incompatibility between the drum and its contents where acids corroded the iron present in the metal drum and produced hydrogen gas. The last report involved the overpressurization of a 55-gallon drum used as a pesticide sprayer. Figure 2-1 shows the distribution of root causes reported by facility managers for these 189 events. Design problem represented 55 percent of the root causes and management problems, 29 percent. Work organization/planning deficiency accounted for 37 percent of the management problems.



Management Problem	Percent
Work organization/planning deficiency	37
Inadequate administrative control	26
Policy not adequately defined or enforced	22
Other management problem	11
Inadequate supervision	2
Improper resource allocation	2

Figure 2-1. Distribution of Root Causes for Error in Equipment or Material Selection[1]

This event illustrates the importance of consulting with manufacturer representatives about precautions or guidelines when using new products or old products in new applications. This is particularly important if the product packaging does not provide warnings or clear instructions for the intended use. Facility managers also need to ensure that procedures and methods for opening sealed drums and containers include precautions and guidance for preventing lids from being blown off. In February 1993, NFS issued DOE/NS-0013, Safety Notice 93-1, “Fire, Explosion, and High-Pressure Hazards Associated with Waste Drums and Containers.” The notice discusses handling, storing, venting, and opening containers suspected of being pressurized or containing flammable vapors. Safety Notice 93-1 can be obtained by contacting the Info Center, (301) 903-0449, or by writing to ES&H Information Center, U.S. Department of Energy, EH-72/Suite 100, CXXI/3, Germantown, MD 20874.

KEYWORDS: pressurized drum, safety, waste handling

FUNCTIONAL AREAS: materials handling/storage, industrial safety

3. ELECTRICAL SHOCK EVENTS RESULT IN SAFETY STAND-DOWN

On April 30, 1997, at Los Alamos National Laboratory, the Dynamic Experimentation Environment Safety and Health Team reported two similar events involving technicians who forgot to isolate energy sources before working on systems. In the first event, a design technician was startled by an electrical arc discharge from a 15 kVDC, 500 uA photocathode in a camera. The design technician was taking measurements on the camera with calipers. In the second event, a technician received a mild electrical shock to his left hand from a 1 kV, 15 mA power supply with 3.5 J of stored energy. The technician was setting up to test electrical components. These two events, and an event reported in February by Dynamic Experimentation personnel, resulted in a safety stand-down of the responsible group. Neither of the events reviewed this week resulted in injury.

[1] OEAF engineers searched the ORPS database using direct cause code “4C” (Design Problem, Error in Equipment or Material Selection) and found 189 occurrence reports containing 189 occurrences.

Investigators determined that inattention to detail resulted in these electrical shock events. (ORPS Report ALO-LA-LANL-FIRNGHELAB-1997-0004)

On April 24, 1997, a camera technician and a design technician were taking measurements to make a lens mounting for a camera used to support a prototype x-ray system. The camera was not turned off or unplugged. When the design technician asked if the camera was safe to work on, the camera technician indicated it was. An indicator light at the top of the camera shows when the camera is energized; however, it was not visible to the technicians because the camera was elevated. Investigators determined that a maintenance technician left the camera on overnight contrary to the procedural shut-down checklist. Also, the camera technician did not pull the power cord and retain it in his control, as mandated by Laboratory policy, before the partial disassembly of the camera.

On April 28, 1997, a technician plugged a power supply into an electrical outlet before terminating the output cable at a meter for a test set up. With the power supply energized, the technician received an electrical shock when he terminated the cable. Investigators determined the power supply did not have indicators that showed the output was energized. The technician had performed the same process two months earlier, but he used a power strip to energize the power supply. The power strip had a red light indicating the status of the power supply.

In both of these events, indicator lights on the power supplies either were not available or were not visible. Engineers evaluated the light indicators; technicians will place them in obvious locations that can easily be seen by the operators.

NFS reported on the February event in Weekly Summary 97-08. On February 11, 1997, a technician violated a procedure and caused a capacitor to discharge three times when he began work on a high-voltage connector in an equipment rack without de-energizing it or grounding the capacitor. Investigators believe the design of the high-voltage connector isolated the operator from electrical shock. They determined the direct cause of the event was inattention to detail and the root cause was inadequate or defective design. Corrective actions included installing (1) visual alarms to indicate when the racks are energized, (2) interlocks on the doors to disconnect ac power, and (3) dump relays to discharge stored energy within capacitors. (ORPS Report ALO-LA-LANL-FIRNGHELAB-1997-0002)

Facility managers conducted critiques of the two recent events. Critique members expressed concern about the occurrence of three events in a short period of time and the possibility of a trend. The Machine Science Technology deputy group leader determined that a group safety stand-down was appropriate. The similarity of the three events and their occurrence in the same group were potentially symptomatic. The Dynamic Experimentation Environment Safety and Health Team reported these events, even though individual startle shock events would not normally be reported under the Laboratory’s existing matrix.

These events demonstrate the importance of using multiple, engineered barriers to prevent hazardous events such as electrical shocks or discharges. Although human performance supported by procedures, policies, memoranda, or standing orders is a standard barrier to prevent electrical shock events, the probability of prevention can be increased by adding barriers. According to the hazard-barrier matrix in the *Hazard and Barrier Analysis Guide*, developed by the Office of Operating Experience Analysis and Feedback, flashing lights are somewhat effective in protecting against high-voltage and current sources. Although adding engineered barriers, such as lights and interlocks, can enforce administrative controls and provide an additional margin of safety, personnel should not become totally reliant on them. Engineered barriers should not be a substitute for sound electrical safety training, safe work practices, or proper work planning. Workers should maintain a questioning attitude and exercise good judgment. Since human error can not be completely eliminated, workers must take responsibility for their actions and perform tasks safely. DOE/ID-10600, *Department of Energy Electrical Safety Guidelines*, section 2.8, provides guidance for training and qualifications of electrical workers.

A copy the *Hazard and Barrier Analysis Guide* is available from Jim Snell, (301) 903-4094. Managers and supervisors should review the guide and incorporate hazard and barrier analyses in work and operation processes.

KEYWORDS: electrical shock, power supply, equipment

FUNCTIONAL AREAS: industry safety, electrical maintenance

OEAF FOLLOWUP ACTIVITY

1. READER RESPONSES TO OEAF REQUEST FOR INFORMATION

In Weekly Summary 97-12, Operating Experience and Feedback (OEAF) engineers published a graph showing the trend of Unreviewed Safety Questions (USQ) across the DOE complex since 1991. We also asked six questions related to the state of safety at DOE. The following is a reprint of the graph, the six questions, and the responses we received for each question.

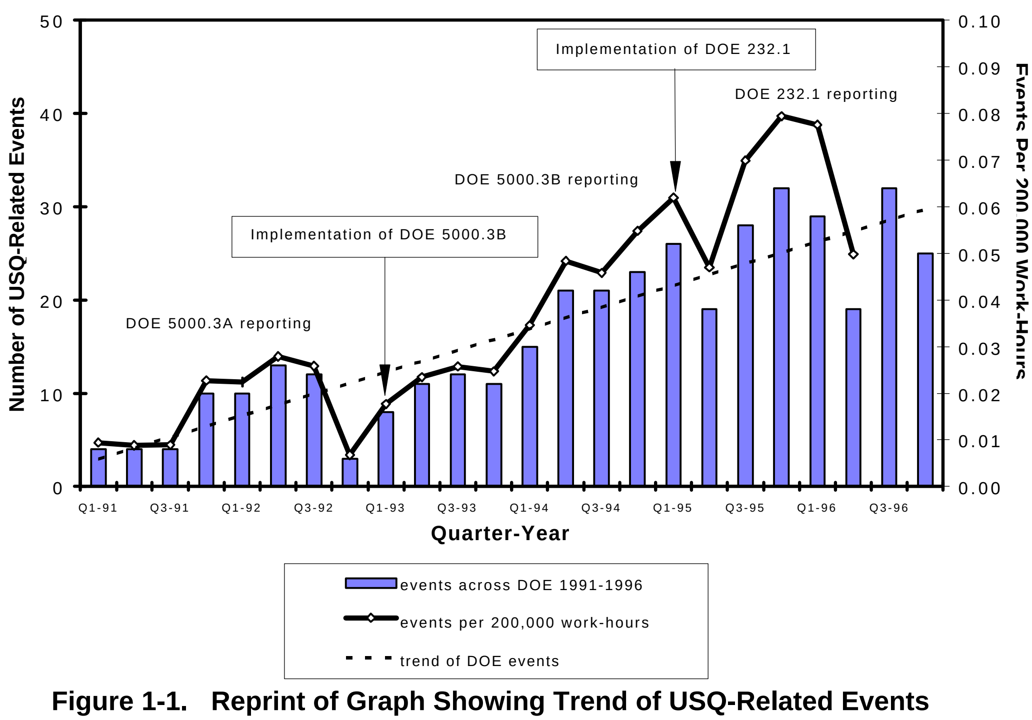


Figure 1-1. Reprint of Graph Showing Trend of USQ-Related Events Across DOE 1991-1996[1]

[1]OEAF Engineers screened the ORPS database for the narrative "Unreviewed Safety Question" and the years 1991 to 1996 and found 400 reports describing 403 occurrences. Based on a random sample of 30 reports, OEAF engineers determined that each column is accurate within ±3.9 percent.

We asked readers of the OE Weekly Summary to respond to the following questions about safety at DOE.

Question 1
In your opinion, is DOE becoming safer from a nuclear safety and industrial safety perspective? What is the basis for this opinion?

Response
Yes, the DOE is getting safer for the following reasons.

- imposition of stricter standards for performance
- development of more accurate reporting criteria
- effect of the Price-Anderson Amendments Act on contractor reporting
- use of numerical performance indicators
- increased use and understanding of ORPS [Occurrence Reporting and Processing System]
- increased emphasis on formal and disciplined conduct of operations

Question 2
What is the reason for the increasing trend of USQ-related events?

Response

- The authorization bases at many sites are old and vague, yet personnel at DOE are striving for 100 percent compliance.
- Personnel have a greater awareness of infractions, use more critical reporting criteria, and work under more stringent requirements.
- There has been an increased awareness in USQs; hence, more are reported.
- Interpretation of reporting requirements across the DOE is inconsistent.
- Personnel are updating out-of-date authorization bases, resulting in more stringent requirements.
- An increase in the number of self-assessments has uncovered previously hidden issues.
- There are new and fewer contractors managing DOE sites, resulting in more problems.
- There is more oversight on fewer types of activities, resulting in greater identification of problems.
- Engineers are performing more rigorous safety analysis than in the past.

Question 3
Does the curve accurately reflect the state of safety at DOE? Is it indicative of an improved ability on the part of DOE personnel to find and report problems? Can a relationship be established between the USQ incidence rate and safety at DOE?

Response
No, for the following reasons.

- The curve does not accurately reflect the state of DOE safety for the reasons noted above.
- There may not be a good correlation between USQs and the state of DOE safety.
- Changing reporting requirements make trend comparisons difficult.

Question 4
What are the best ways to measure safety at DOE? Should safety be limited to the probabilities and consequences of design basis accidents, or should safety also include issues related to worker safety and equipment damage?

Response
- There is no best way to measure safety; however, it should not be limited to design basis accidents, which do not account for normal operations or for common occurrences. Safety indicators should include normal and rare events, as well as all receptors.
- A set of performance measures that incorporates many aspects of safety performance is needed. The indicators need to be rigorously developed and analyzed.
- Safety should be measured using all criteria mentioned in the question.
- Proper statistical analysis is required to best measure safety.

Question 5
What are the best ways to measure risk? Can risk be quantified?

Response
- There is no best way to measure risk. DOE-STD-3009-94 and other current standards allow for a "qualitative" means to identify controls and risk acceptability. Risk can be quantified, but what do the numbers really mean?
- Instead of trying to measure risk, it would be better to adopt total quality and try to improve continuously.

Question 6
What are the best ways to measure the effectiveness of corrective actions?

Response
- Select a meaningful set of performance indicators, then determine which ones reflect performance that is supposed to be improved by corrective action. Track and analyze these indicators.
- Plot a control chart of performance measure. Implement the corrective actions to see if there is a statistically significant improvement.
- Measure the number of repeat occurrences to see if there is a positive trend.
- Determine if the breakdown recurs or the same type of problem arises again.

The best indicator of safety, the best measure of corrective action effectiveness, and the best guarantee of low risk is a management system that builds safety from the ground up and involves employees in looking for problems and deciding the best and most efficient way to correct them.

OEAF engineers wish to thank readers from Savannah River, Rocky Flats, Idaho National Engineer Laboratory, and Hanford for generously responding to our request for information. The opinions expressed in the responses are solely the opinions of the respondents. The OEAF engineers shortened and paraphrased some of the responses in the interest of space and clarity.

KEYWORDS: safety, unreviewed safety question

FUNCTIONAL AREAS: nuclear/criticality safety, industrial safety